Amendment under Article 34

PCT/JP2004/013158

[0013]

That is, an infrared sensor IC comprises a compound semiconductor sensor, having a compound semiconductor layer grown on a **substrate** as a thin film, including indium and antimony, and detecting an infrared radiation by the compound semiconductor layer to output an electric signal indicating the detection; and an integrated circuit processing said electric signal output by the compound semiconductor sensor to perform a predetermined operation, wherein the compound semiconductor sensor and the integrated circuit are arranged in a single package in a hybrid manner.

[0019]

An infrared sensor according to a seventh mode of the present invention comprises a substrate; and a compound semiconductor stacked layers formed on said substrate by stacking a plurality of compound semiconductor layers, the compound semiconductor stacked layers comprising a sixth compound semiconductor layer, formed on the substrate, that is an n-type doped material including indium and antimony; a seventh compound semiconductor layer, formed on the sixth compound semiconductor layer, that is a non-doped or p-type doped material including indium and antimony; and an eighth compound semiconductor layer, formed on the seventh compound semiconductor layer, that is a material that is p-doped at a higher density than the seventh compound semiconductor layer and has a larger band gap than the sixth compound semiconductor layer and the seventh compound semiconductor layer. The sixth compound semiconductor layer may be InSb, the seventh compound

semiconductor layer may be one of InSb, InAsSb and InSbN, and the eighth compound semiconductor layer may be either AlInSb or GaInSb, or one of AlAs, InAs, GaAs, AlSb and GaSb, or a mixed crystal of them. Further, an n-type dopant for the sixth compound semiconductor layer may be Sn, and a p-type dopant for the seventh compound semiconductor layer and the eighth compound semiconductor layer may be Zn.

[0024]

An infrared sensor manufacturing method according to a ninth mode of the present invention comprises the steps of: forming, on a substrate, a sixth compound semiconductor layer that is an n-type material including indium and antimony; forming, on the sixth compound semiconductor layer, a seventh compound semiconductor layer that is a non-doped or p-doped material including indium and antimony; and forming, on the seventh compound semiconductor layer, an eighth compound semiconductor layer that is a material that is p-type doped at a higher density than the seventh compound semiconductor layer and has a larger band gap than the sixth compound semiconductor layer and the seventh compound semiconductor layer. The sixth compound semiconductor layer may be InSb, the seventh compound semiconductor layer may be one of InSb, InAsSb and InSbN, and the eighth compound semiconductor layer may be either AlInSb or GaInSb, or one of AlAs, InAs, GaAs, AlSb and GaSb, or a mixed crystal of those. Further, an n-type dopant for the sixth compound semiconductor layer may be Sn, and a p-type dopant for the seventh compound semiconductor layer and the eighth compound semiconductor layer may be Zn.

[0036]

According to the mode of the invention, the first compound semiconductor layer, the second semiconductor layer and the third semiconductor layer may also be p-type doped. Be, Zn, C, Mg, Cd, or Ge is used as a preferable p-type dopant. In this case, the doping density is the density of the impurity atoms doped in a compound semiconductor. The p-type doping density is 1×10^{16} to 1×10^{17} atoms/cm^3, and more preferably, 2×10^{16} to 5×10^{16} atoms/cm^3.

[0044]

The elements previously described can be used for a p type dopant. Si, Sn, Te, S, or Se, etc. , can be considered preferable for an n type dopant. Fig. 5 is a cross-sectional view of an example compound semiconductor sensor 2 wherein a stacked layers 12 formed of compound semiconductors is deposited on an n-type GaAs substrate 6 (electrodes 13 are not shown). In the example shown in Fig. 5, the compound semiconductor stacked layers 12 includes three layers, a high-density n-type doped layer 12a/a low-density p-type doped layer 12b/a high-density p-type doped layer 12c.

Claims:

1(Amended). An infrared sensor IC comprising:

a compound semiconductor sensor, having a compound semiconductor layer grown on a **substrate** as a thin film, including indium and antimony, and detecting an infrared radiation by said compound semiconductor layer to output an electric signal indicating the detection; and

an integrated circuit processing said electric signal output by said compound semiconductor sensor to perform a predetermined operation,

wherein said compound semiconductor sensor and said integrated circuit are arranged in a single package in a hybrid manner.

13(Amended). An infrared sensor comprising:

a substrate; and

a compound semiconductor stacked layers formed on said substrate by stacking a plurality of compound semiconductor layers,

said compound semiconductor stacked layers comprising:

a sixth compound semiconductor layer, formed on said substrate, that is an n-type doped material including indium and antimony;

a seventh compound semiconductor layer, formed on said sixth compound semiconductor layer, that is a non-doped or p-type doped material including indium and antimony; and

an eighth compound semiconductor layer, formed on said seventh compound semiconductor layer, that is a material that is p-doped at a higher carrier density than said seventh

compound semiconductor layer and has a larger band gap than said sixth compound semiconductor layer and said seventh compound semiconductor layer.

23(Amended). An infrared sensor manufacturing method comprising the steps of:

forming, on a substrate, a sixth compound semiconductor layer that is an n-type material including indium and antimony;

forming, on said sixth compound semiconductor layer, a seventh compound semiconductor layer that is a non-doped or p-doped material including indium and antimony; and

forming, on said seventh compound semiconductor layer, an eighth compound semiconductor layer that is a material that is p-type doped at a higher carrier density than said seventh compound semiconductor layer and has a larger band gap than said sixth compound semiconductor layer and said seventh compound semiconductor layer.